UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

BIG HOLE BASIN FOREST INSECT CONTROL PROJECT

BEAVERHEAD NATIONAL FOREST

Report for the Season of 1928

December 12, 1928

U. S. GOVERNMENT PRINTING OFFICE: 1928 J 76133

BIG HOLE BASIN FOREST INSECT CONTROL PROJECT

Report for the Season of 1928

(4)

Contents

	Page
INTRODUCTION	1
HISTORY OF PROJECT	1
CHARACTER OF THE INFESTATION	3
ENTOMOLOGICAL PLAN OF CONTROL	4
1928 CONTROL OPERATION	6
Organization	11
Spotting	13
Treating	15
Costs	22
FOREST PERSONNEL AND COOPERATION	30
FOREST INSECT RECONNAISSANCE	31

BIG HOLE BASIN FOREST INSECT CONTROL PROJECT

BEAVERHEAD NATIONAL FOREST

Report for the Season of 1928

INTRODUCTION

The scope of this report includes an account of the 1928 control operation and the result of the past season's insect reconnaissance. Inasmuch as this paper will be considered as a final report of the Big Hole Basin control project, it seemed advisable to include a brief history of the project, plan of control, etc., as a matter of convenience to the reader.

HISTORY OF PROJECT

In 1909 a serious outbreak of the mountain pine beetle occurred in the lodgepole pine stands of the Flathead National Forest. This epidemic spread south along the west side of the Continental Divide, and by 1920 had crossed the northern portion of the Missoula National Forest. In 1923 it was realized that the open country along the Clark's Fork River had not checked this spread and that the insects were firmly established in the timber stands to the south. In an attempt to stop the further spread of this epidemic control measures were instituted in 1924 against what was believed to be its furthest

advance elements. During this operation, which was located near Philipsburg, Montana, approximately 1,000 trees were treated. From an insect reconnaissance which followed the close of this operation, it was found that instead of having treated the advance elements, the head of the infestation was still some 30 miles to the south. It was found that a serious epidemic condition existed on the East Fork of the Bitterroot River, and in 1925 control operations necessarily were moved to that region. At that time 7,725 trees were treated around what appeared to be the edge of the heavy infestation. There were, however, thousands of trees within the area which were left untreated.

An insect reconnaissance conducted during the summer of 1925 showed that the insects had started to cross to the east side of the Continental Divide and were fairly well established within that region. This fact made it necessary to include the west side of the Big Hole Basin in the 1926 plan of control. During that season 1,244 trees were treated within the Bitterroot, and 5,271 within the Big Hole Basin. The heavy flight of beetles from the Bitterroot to the Big Hole Basin, which occurred during the summer of 1926, made it necessary to forego further control work within the Bitterroot and to concentrate all available funds within the Big Hole Basin for the 1927 season. During that year some 17,500 trees were treated at a total cost of $31,205. A survey of the region following the close of the 1927 control operation showed that the insects were established on the

east side of the basin, which made it necessary to include that area in the 1928 plan of control. During this survey it was found that a serious epidemic of the mountain pine beetle in lodgepole existed within the Salmon National Forest, which was just across the Continental Divide from the head of the Big Hole Basin. Though the danger of the insects spreading from the Salmon epidemic into the areas to the south of the Big Hole Basin was fully recognized, it did not deter the continuation of the project, as no assurance could be given that such a flight would occur.

In 1928 there were 55,000 infested trees within the Big Hole Basin treated at a cost of approximately $90,000, which resulted in a very good clean-up of the areas under consideration. The result of the survey which followed this operation is given under the caption "Forest Insect Reconnaissance".

CHARACTER OF THE INFESTATION

At the present time we are confronted with the task of trying to check the spread of two epidemics which are of such magnitude that the thoughts of attempting to treat all the infested trees within the two areas are impracticable. It seems impossible to even attempt a depiction of the severe losses of lodgepole pine and yellow pine which have occurred within these two regions during the past few years. In the heart of these infestations practically all of the trees above 6" D.B.H. over many square miles have been killed. These heavy blocks

of infestation act as a source of supply for the spread of insects into the Beaverhead. The epidemic first spreads from these solid blocks of infestation as large groups of infested trees which in turn give way to smaller groups and isolated individuals at the limits of the spread. The distance which these insects are able to fly is still debatable, but one can safely assume that under favorable conditions a flight of twenty or more miles may be expected.

From the heart of the infestation on the East Fork of the Bitterroot River the epidemic is spreading in three directions. To the north the insects have spread through the Bertie Lord, Moose, and Martin Creek drainages, and are now firmly established in the Rock Creek drainage of the Missoula Forest, and will in a year or two undoubtedly reach the Weeping Child and Skalkaho drainages of the Bitterroot. To the southwest there is an annual encroachment into the Tolan and Mink Creek drainages, and it is possible that in time the epidemic may reach the valuable timber stands of the West Fork. Across the Continental Divide the insects are spreading south into the Big Hole Basin.

There can no longer be any doubt but that the infestation from the Salmon Forest is spreading into the southern portion of the Beaverhead, and possibly the head of the Big Hole Basin.

ENTOMOLOGICAL PLAN OF CONTROL

At the time this project was instituted the magnitude of the Bitterroot infestation made the thoughts of treating all the infested trees in any one season seem prohibitive. This position seemed warranted

because of the tremendous expense of such an operation, as well as the physical difficulty of covering all of the infested area in one or two years. However, in order to prevent the spread of this infestation through the Big Hole Basin and into the more valuable timber stands to the south, the Forest Service and Bureau of Entomology approved, on an experimental basis, what has been called a defense zone, or barrier plan of control. This plan called for the establishment of a zone across the head of the infestation in which all infested trees were to be treated each year until such a time as reinfestation no longer occurred within the zone. Because of limited funds it was impossible to consider the northern spread of this epidemic, but a zone covering the Big Hole Basin and reaching across the East Fork of the Bitterroot River was adopted in the hope of preventing further spread to the south and southwest. In 1927 it was necessary to abandon the Bitterroot portion of this zone and turn all available funds to the Big Hole Basin in the hope of checking the southern spread of the insects into the more valuable timber stands to the south. The presence of the Salmon infestation places the continuation of the present plan of control in an untenable position, for the infestation to the south would need to be considered in all future plans of control. There is no place within this report for a discussion of the merits of the plan which has been in operation for the past three years, and which now must be abandoned; but at that time it was adopted as offering the only feasible chance of preventing the spread of this epidemic into the valuable timber stands to the south.

1928 CONTROL OPERATION

A preliminary report covering 1928 control operations on the Big Hole project was submitted July 15, 1928, by C. S. Webb. At that time complete cost and production records were not available. In this report these records are given in considerable detail, although the total costs are but slightly changed.

The project was in charge of C. S. Webb, Logging Engineer, District 1. J. C. Evenden, Entomologist, Bureau of Entomology, handled the work for this Bureau in connection with the project.

The area worked lies on the west side of the Big Hole Basin, extending from Fishtrap Creek on the Deerlodge National Forest south to Miner Creek on the Beaverhead Forest, a distance of about 50 miles. Also, on the east side of the basin, work was done from Wise River southerly to Sheep Creek on the Beaverhead, which is a strip about 50 miles in length. Elevation ranges from 6,000 to 7,000 feet above sea level. The area is within Twp. 1 N., Rgs. 11, 12, 13, 14, 15 and 16 W.; Twp. 2 N., Rgs. 14 and 15 W.; Twp. 1 S., Rgs. 13, 14, 16 and 17 W.; Twp. 2 S., Rgs. 14, 15 and 17 W.; Twp. 3 S., Rgs. 14 and 17 W.; Twp. 4 S., Rgs. 14, 15 and 17 W.; Twp. 5 S., R. 16 W.; and Twp. 6 S., R. 16 W., M.P.M., Beaverhead and Deerlodge National Forests, Montana.

On March 28, Webb went to Wisdom for the purpose of looking over field and snow conditions. Snow was much lighter than the previous year at that time. It was decided preparatory work should be commenced as

there was considerable to do in a project of this size and little time to be lost if the project was to be carried out and cleaned up by June 30. The tools and equipment stored at Wisdom, which were in use the previous season, had to be sharpened and repaired. Hay could be hauled into several camp sites. It was possible to haul out considerable equipment on sleighs for the Battlefield and Mussigbrod units. One carload of food supplies and two carloads of camp and treating equipment had been ordered. This had to be moved from Divide, Montana, a station on the Oregon Short Line Railway, to Wisdom where headquarters were to be established. This haul is 55 miles each way, and it was evident this hauling must be done early before the frost left the ground.

At this time a few men were engaged to do this preliminary work, equipment and supplies were shipped to Divide, and trucks engaged in hauling. This work was left in charge of Ranger M. G. Ramsey, while Webb returned to Missoula to make necessary outside arrangements for securing men, putting out bids for the hire of trucks, horses and food supplies.

On April 10, Webb returned to Wisdom with four men, rented an office room and additional warehouse space, and opened up a central office and warehouse. The balance of the month of April was taken up in establishing office, warehouse facilities, putting equipment in shape, trucking in equipment and supplies from Divide, pressing and hauling hay, hauling out and setting up two camps on the east side, and hauling out the equipment for eight camps on the west side to points where it could be

stored until weather and snow conditions were such that the camps could be set up. Much cold, snowy, blizzard-like weather was experienced all through April. The temperature reached 20° below zero on Easter Sunday morning and it was necessary to place extra stoves in the warehouse.

The first camp which commenced treating trees was Francis Creek on the east side, which started May 1. Steele Creek was next, beginning work May 3. Weather conditions changed for the better the first part of May. There was yet considerable snow remaining on the areas to be worked, but it disappeared rapidly. The moving out and establishing of camps progressed very well. On May 25, the maximum of 25 camps, employing about 450 men including forest officers, had been established and were producing. These were kept fully manned and supplied up to June 13, at which time it appeared necessary to commence reducing the force on account of exhaustion of funds. The pulling of camps commenced with Steele Creek camp on June 13, and by June 21 the men at camps were all released, the only ones remaining were a few necessary for the hauling in and warehousing of equipment and supplies.

Sixteen kitchen and mess outfits, several dozen axes, shovels and mattocks, approximately 480 beds, consisting of 2,400 blankets and 480 tarps, two truck loads of subsistence supplies, office fixtures and some left-over commissary were trucked back to the Missoula warehouse. The greater bulk of equipment was stored at Wisdom and there was also stored non-perishables, as coffee, spices, sugar, etc., in tins to a value of about $500.00.

The work was started as soon as thawing of snow would permit. It was pushed hard from start to finish, perhaps pushed a little too fast to permit of the greatest economy. Had the organization been built up somewhat slower, thus carrying the work along closer to the end of June, it might have proved a little more efficient. We could not, however, overlook the adverse weather and labor conditions which it was entirely possible to encounter during the life of the job, and it was considered advisable to go as fast as possible while we had the men and favorable weather.

Practically all of the equipment and supplies, about four carloads, were trucked in from Divide. Roads were very bad, as this stuff had to be hauled early while the snow was melting and frost leaving the ground. Men came in the same way up to about May 25 when the Big Hole-Bitterroot Divide was opened. After this time the necessary supplies and men were hauled directly from Missoula, a distance of about 130 miles.

The hauling of men and supplies from and to outside points was contracted. Hauling out of Wisdom to the camps ranged from 5 to 35 miles. This was done by teams, two Government-owned trucks and other trucks hired for trips as needed.

Approximately 100 horses were employed when the work was at its height. There were in use four pack strings having a total of 32 head, 60 skidding horses, and a few other horses used in team work and as saddle horses. Horse fatalities consisted of one killed, one died, and

two alleged to have been injured. Claim was made for the one killed in the amount of $100.00, and this has been paid. Claim has been made in the case of the latter three for a sum total of $120.00. This has not yet been paid. There were 3,569 horse-days spent on the job, as follows: 1,778 days for skid horses, 347 days for team horses, 1,098 days for pack horses, and 346 days for saddle horses, which includes the four packers' saddle horses. The rate paid for these was 50¢ per day for pack horses; 75¢ per day for work horses; and $1.00 per day for saddle horses. The pack horses were equipped by the Government and all others were equipped by the owners. The cost of maintaining these horses, which includes cost of hay and oats, transportation on same, pasturage, shoeing and medicines, averaged 95.3 cents per horse per day.

There were employed on the project 15,308¼ man-days, 445 days of which was contributed time. Figuring the salaries and expenses of these contributed men as an actual cost, as well as all those paid from the allotment, the total cost of preparation, transportation, horse hire, maintenance horses, labor, man subsistence, equipment and supplies and miscellaneous expense cost at the rate of $6.42 per man-day. Production was at the rate of 3.6 trees per man-day, and gross cost is $1.78 per tree on this basis. In the working of these 15,308¼ man-days, which on account of turnover required the employment of about 1,000 individuals, we were fortunate in having no fatal accidents. There were, however, twenty compensation cases, mostly involving axe cuts and sprains, but one case of bad injury and broken bones. The cost of boarding these men, based on

47,660 meals, was 48.8 cents per meal, which includes subsistence supply costs of 36.7 cents, transportation of same 3 cents, and wages of kitchen men 9.1 cents. Detailed production records and costs are given later in this report.

A. Organization

Wisdom, Montana, was selected as the central point as a headquarters from which to handle the job. The office and warehouse was located here. The central overhead force consisted of C. S. Webb in charge; Philip Neff as assistant in establishing camps and field supervision; R. W. Strong, chief clerk; Ed. Hoell and O. F. Beck, assistant clerks, doing vouchering, handling commissary and mail, keeping records, purchasing, and handling other routine office work. Mr. Strong had complete charge of accounts and was special disbursing agent in cases where cash labor payments were necessary. All other bills and a part of the payroll were put through the Fiscal Agent's office at Missoula for payment. Ranger A. J. Kramis was in charge of the warehouse and property. These men are all forest officers of District 1. Entomologist J. C. Evenden represented the Bureau of Entomology and assisted in the organization of the job. Two truck drivers were employed steadily, 1 teamster, 1 warehouse assistant, and 1 handy man, all of whom were headquartered at Wisdom.

The field area was divided into six units and each unit placed directly in charge of a forest officer on the ground. The unit

managers were W. W. White, Wise River unit; G. M. DeJarnette, East Side unit; Harold G. Peterson, Pintlar Lake unit; Thomas Crossley, Mussigbrod unit; W. T. Winston, Battlefield unit, and Harvey Corley, Lake Creek unit. Each unit had a number of camps, varying from two to nine at times, as some camps upon completion of their area were transferred to other units. The East Side and Mussigbrod units were the heaviest from the standpoint of number of camps and trees treated. The men in charge of these units are all District 1 forest officers. This amount of overhead may appear heavy, but is necessary in order to build up an efficient working organization of this size so quickly as was done here. In fact, another competent clerk and one more competent man on field supervision would not have been too much, whereas if a longer period, six months for instance, could be had in which to organize and do the job, it could be handled efficiently with less overhead in numbers than was employed.

Under the unit managers were the various camps. Each camp was in charge of a camp manager who was responsible to the unit manager for the records of his camp, and was also in charge of either a spotting crew or treating crew. Where more than one treating crew was employed in a camp, each was in charge of a crew foreman. These foremen were productive and worked with their small crew of 4 or 5 men. At least one spotting crew was placed at each camp and in some there were two or three. Spotting crews were in charge of a chief spotter and were of various sizes: 2 men, 3 men and 5 men crews. In some cases one man worked alone, but seldom less than two.

B. Spotting

Spotting crews were organized consisting of 2, 3, or 5 men, depending upon which size was considered the most feasible and economical for a given camp area. Most of the area within the East Side and Wise River units was spotted by 2-man crews. This depended upon topography of the area to be worked, character of timber stand, and intensity of infestation. Areas containing strips and patches of mature timber broken up by open parks of various sizes, and intermingled with strips of young growth could be spotted up to good advantage by 2-man crews going in and working out such patches and strips. A rough map was prepared showing drainage and the approximate location of trees spotted. Each crew was given a serial symbol as A, B, C, etc., and each man carried a hand axe, tacks, cloth tags 4"x6", and crayon. All infested trees found were blazed and a cloth tag tacked thereon bearing the crew serial symbol and consecutive number of the tree for this crew, i.e., Crew "A" marking its 33d tree, the tag would show "A-33", thus giving an opportunity to check up on the work as done by each crew. The maps showed the trees by numbers or groups of trees by inclusive numbers contained in the groups, and the treating crew foreman could take the maps later and find the trees with little difficulty. On areas of solid old growth in fairly open stand and easy topography which would permit of a man covering considerable distance in a day, it was found advisable to use 3-man crews. Of these, one was in charge and responsible for the work of the crew. He did the compass work, pacing and mapping while one man worked on either side of him, each covering a

strip 2 or 3 chains wide, searching for infested trees. In case of groups of trees being located, all hands turned in and helped spot up the group. In case of the scattered individual trees, the spotter who found the tree spotted it.

On areas of old growth with considerable infestation which had to be covered by systematic 100 per cent cruise stripping, where the topography was more rough and stand dense with some brush in places, it was desirable to use 5-man crews in order to do as clean a job as possible. These crews worked the same as the 3-man crews, except two men worked either side of the chief spotter, each covering a strip one chain wide.

On the east side 2-man crews averaged 48.3 trees per man-day, acres covered being 33.56 per man-day; whereas on the Pintlar Lake unit, offering much easier topography, the three and five-man crews spotted 30.3 trees per man-day, covering 32.96 acres per man-day. Acres covered per man-day are about all the comparison which can be made between the methods and in such a comparison the number of trees per acre and the topography must be considered. It is thought the small crews have a place under such conditions as we used them, but they would have no place on areas of solid old growth which is more or less infested and which, in order to make a good clean-up, must be systematically covered. As an extreme comparison 2-man crews on the Wise River unit covered 62½ acres per man-day, while on the Mussigbrod unit 5-man crews covered but 24 acres per man-day. On the whole the latter had the easier topography, but the former had experienced forest officers as chief spotters, while the latter had many

temporary men, several of the chief spotters being temporary men with no previous experience in this sort of work. A maximum of 27 spotting crews was used.

C. Treating

The general plan was to organize treating crews consisting of 1 foreman, 2 sawyers, 2 laborers, 1 driver, and 1 skidding horse, a total of 6 men and 1 horse, all considered as productive. We wanted to experiment with some 5-man crews also and a number were so organized. Working on a day basis there seemed to be little difference in the effective man-day production between the 5- and 6-man crews. Several camps did some gyppo or contract work by assigning a certain area to a crew to treat at a specified price per tree, which would be the lowest bid made by several offering to do the work. In these cases usually four men went in together and took a horse. They boosted their production up to about 10 trees per effective man-day, but at the price they took it none of them except one crew made very much more than wages. From 1 to 6 treating crews were employed in various camps, the majority being 2-crew camps with several working three crews. The 25 camps at the height had 55 such crews.

The foreman had charge of and was responsible for the work of his crew. Certain areas were assigned to the crew foreman by the camp manager and with the aid of the map prepared by the chief spotter, the

infested trees were located and treated. About 90 per cent of the trees treated were felled, cut into log lengths, limbed, and the infested portion (average two log lengths or 32 feet) was skidded into piles and burned. The slash was handled by piling and burning along roads, trails, creeks and around lakes and camp grounds where people are apt to frequent. In other places it was lopped from the stems and left upon the ground. The remaining 10 per cent were not cut but were burned standing. This was accomplished by piling dry limbs, poles and slash around the trees and burning, and in some instances by placing log decks against infested trees and burning the decks. To secure a satisfactory burn on standing trees in the latter method required the piling of considerable slash up against the tree on the opposite side from the log pile. It was possible to treat, in this way, only such individual trees as stood out by themselves. In the more dense stands this method would result in injury to thrifty trees and reproduction standing close by.

There were but 25 camps in use but a number of these were moved and there were in all 37 camp settings.

The following tabulation "Man-day Record" gives an idea of the various sorts of work entering into the job on the ground, and shows what the time was spent on at the camps. This is direct camp time only and does not include overhead, unit managers and transportation of men.

The second tabulation "Production Record" shows the number of trees spotted and number treated by units and the production per actual effective day on the work, as well as production on the basis of total camp days in field.

MAN-DAY RECORD

SPOTTING AND TREATING CREWS

Does not include time of unit managers except on Lake Creek unit

Name of Unit	Wise River	Pintlar	Mussigbrod	Battlefield	Lake Creek	E. Side	Job Total
Name of Unit Manager	White	Peterson	Crossley	Winston	Corley	DeJarnette	
Item							
1. No. Trees Treated	3567	11527	12479	3454	2908	21,110	55,045
2. " Meals Served	2384	7772	10841	4050	2357	15,930	43,304
3. Days Moving Camp	25½	85	67½	31	37	155 5/8	401 5/8
4. " Establishing Camp	14½	60	60	43	33	96	306½
5. " Fire Suppression	--	--	2½	--	--	4¼	6¾
6. " Hauling & Cutting Wood	5	41	82	35½	18	74 3/8	255 7/8
7. " Cooks	31	113½	219	97½	64	300½	825½
8. " Flunkeys	--	123½	182	40	35	263	643½
9. " Saw Filer	1	8½	6	3	10¼	13	41¾
10. " Maintenance Horses	10	12	12½	5	5	28	72½
11. " Roads & Trails	5	2	17½	9	--	52	85½
12. " Telephone Cons't.	--	--	--	--	--	6½	6½
13. " Supervision	--	24½	--	--	--	8¾	33¼
14. " Misc.	--	--	2	--	--	4½	6½
15. Effective Days Spotting	64	378	638	368	94	479	2021
16. Non-effective Days "	17½	94	134	55	40	202½	543
17. Total " "	81½	472	772	423	134	681½	2564
18. Effective Days Treating	438	1448½	1521	478½	362½	3159½	7408
19. Non-effec. " "	74½	376	517	209	162¼	804	2142¾
20. Total " "	512½	1824½	2038	687½	524¾	3963½	9550¾
21. Total all Days	594	2296½	2810	1110½	658¾	4645	12114¾

Note: 3 to 14 inclusive = 16 + 19.
21 = 17 + 20.

effective days treating 7408
spotting 2021
9429

9429 ÷ 12114 = 79% effective days

PRODUCTION RECORD

Shown both on effective and total man-day basis

Unit	Manager	TREATING :: No. Trees Basis	TREATING :: No. Trees per effec. Man-Day	TREATING :: No. Trees per man day Total Days	SPOTTING :: No. Trees Basis	SPOTTING :: No. Trees per effec. Man Day	SPOTTING :: No. Trees per man-day Total Days
Wise River	White	3567	☒ 8.0	6.96	3444	53.8	42.3
Pintlar	Peterson	11527	☒ 8.0	6.32	11455	30.3	24.3
Mussigbrod	Crossley	12479	☒ 8.2	6.12	13663	21.4	17.7
Battlefield	Winston	3454	☒ 7.2	5.02	4320	11.7	10.2
Lake Creek	Corley	2908	☒ 8.0	5.54	2628	27.9	19.6
E. Side	DeJarnette	21110	☒ 6.7	5.33	23202	48.3	34.0
Job	Total	55045	7.43	5.76	58712	30.25	22.9

☒ Wise River Unit: Swamp Creek Camp high with 9.1, Hughes Camp 8.4, and Wise River Camp 7.9.

☒ Pintlar Unit: Howell Creek high with 8.4, Pintlar Lake and Paddock each averaged 8.1 and Dry Creek is low with 7.0.

☒ Mussigbrod Unit: Johnson Creek high with 9.6, Headquarters 8.4, Plimpton 8.1, Clam Valley 8.0, Bender Creek and Lake Camps tied for low at 7.5 trees per effective man-day treating.

☒ Battlefield Unit: Tie Creek high with 7.9, Moosehorn 7.0, Butler Creek 6.9 and Battlefield low with 6.0.

☒ Lake Creek Unit: Big Lake and Sawmill Creeks high with 10.8, Miner Creek 8.8, Mifflin Creek 7.9 and Moose Creek low with 4.0.

☒ East Side Unit: Doolittle Ridge Camp high with 8.8, Francis and McVey tie for second with 7.4, Doolittle Creek 6.8, Sheep Creek 6.6, Salefsky, Steele and Pony Creeks each 6.3, Squaw Creek and Toomey Creek tied for low at 5.8 trees treated per effective man-day.

In reviewing this man-day record the working conditions affecting each unit must be given due consideration. The fact that a certain unit or a certain camp ran below the average in production does not necessarily mean this camp or unit was below the average in efficiency, or that it was poorly managed.

The Pintlar unit was considered the most easy to work. Ground fairly smooth, open, and clean, with easy topography. There were no pack camps, each one being reached directly by truck. Dry Creek was the most difficult to work from the standpoint of topography and poor camp location.

The Mussigbrod unit is placed second. This offers more of a transportation problem, as there are several camps which must be reached by pack horses. Roads and trails are available and campsites are available for close proximity to the work. Topography is mostly easy, there being but one camp, Mussigbrod Lake, which offers steep, rocky ground.

The Lake Creek unit is placed third. In most instances the smooth and level topography of this unit is even better than on the Mussigbrod unit. There is much low, swampy ground, and a great many large creeks which in the spring cause considerable difficulty and delay in moving around. This season the infested trees were sparse in most places which meant considerable moving of camps and considerable walking time to and from work.

The Battlefield unit is placed fourth. For the most part the topographic conditions are very good. One pack horse camp at Tie Creek, the other three being reached by team or truck, except Butler Creek to

which a truck could not be taken. This season all of these camps, except Tie Creek, had a very sparse stand of infested trees, 1 tree to 4 acres. This accounts largely for the low man-day production in both spotting and treating. The area had to be systematically stripped 100% in order to clean up. Noneffective time also appears greater than on other units in comparison.

The Wise River unit is placed fifth. This unit has much very steep ground and is badly broken up with old burns, areas of reproduction and mature timber, thus causing the groups of infested trees to be more or less scattered. Wise River camp stayed at Wise River Hotel which made a long trip back and forth to the work. The unit was farthest from headquarters and received the poorest service. The spotting was all done by one and two-man crews.

The East Side unit as a whole is considered the most difficult to work. Fourteen campsites were used on this unit. Two of these were supplied with a team most of the time and two were supplied by truck. The others were reached with pack horses. The topography is much more steep and rough than found on the west side of the Big Hole Basin. It was necessary, because of lack of water where needed, to place several camps at points which were not advantageous to the work, notably Steele Creek and Francis Creek.

The topography is very much broken up and the timber stand is likewise broken by areas of young growth, thus making the areas to be worked over very patchy. Spotting on this unit was done mostly with one and two-man crews.

The "Production Record" sheet shows there were 58,712 trees spotted and 55,045 treated, leaving 3,667 spotted trees untreated. Some units treated a few more than were spotted. This is because the crew foremen pick up a few trees now and again which were missed by the spotters, and these are carried as extras not entering into the spotting record. For this reason there may be at least 4,000 trees which were spotted that were not treated. These spotted trees were left at Squaw Creek, Salefsky Creek, McVey Creek and Doolittle Creek on the East Side unit; Dry Creek on the Pintlar unit; Tie Creek on the Battlefield unit, and Bender Creek, Plimpton Ridge and Clam Valley on the Mussigbrod unit.

As an indication of the progress made in the treating work, the following is given:

Period Ending	Trees Treated per Week	Trees Treated Job to Date
May 5	165	165
May 12	1273	1438
May 19	5291	6729
May 26	9205	15934
June 2	11849	27783
June 9	12997	40780
June 16	10333	51113
June 23	3932	55045

The trees averaged about 14 inches in diameter on the stump, and length treated is about 30 linear feet per tree.

The first camp was pulled out June 13 and the last closed June 21.

A summary of the area and trees worked on the two forests follows:

BEAVERHEAD		DEERLODGE		TOTAL	
Acres Spotted	Acres Treated	Acres Spotted	Acres Treated	Acres Spotted	Acres Treated
54,619	51,649	9,280	8,631	63,889	60,280
Trees Spotted	Trees Treated	Trees Spotted	Trees Treated	Trees Spotted	Trees Treated
50,071	47,058	8,641	7,987	58,712	55,045

D. Costs

Next to the successful treating of trees so as to destroy the greatest number of insects possible, the matter of costs is the most important thing for consideration. Costs have been lowered each season on this project, but were not lowered as appreciably as hoped for this season. The 1926 costs were $2.27 per tree, 1927 at $1.78 per tree, and this season (1928) at $1.622 per tree.

The actual spotting and treating of the trees based on the effective man-days worked by the crews is less than half of the total cost. Various factors of costly work enter into the total. Camps must be moved out and set up; tools sharpened and repaired; roads, trails, fences and bridges repaired and built; camp expenses are necessary such as fuel, cooks' wages, etc.; a large amount of equipment is necessary, and quite a number of horses are required which must be maintained principally on hay and oats.

Other items of cost are the overhead and transportation necessary in moving and supplying the camps; travel expense; and rent, telephone bills, and things of that nature.

This season fares were paid for laborers coming in from Butte or Missoula, and if they remained on the job a period of 21 working days or longer, their return fare was paid. Forty-three forest officers were detailed to the project this season. Five came from District 4, one from District 2, one from District 6, and the remainder, or 36, came from various places throughout District 1. These men were not on constantly, but the average for the period May 10 to June 15 was approximately 40 men. Most of these 43 men traveled relatively long distances to and from the job, and were on pay and travel expense while en route. The item of forest officers' travel expense amounts to $2,237.59, or about 2.5 per cent of the total expenditure, while the amount paid out in travel for temporary men is about equivalent. Forest officers' salaries are rather high in many instances, considering the class of work assigned to them, but it is thought their familiarity with much of the work, and the added impetus which they put into the job well offsets the added salary expense.

It is felt that the greatest element making high costs is the short period in which work must be done. A rush job usually gathers up more or less inefficiency here and there. The cost of moving in and setting up all the equipment necessary for an outfit of the size used is heavy, since it must be done at the time of year when weather and roads are bad. The cost is nearly as great for a short period of a few weeks

as it would be for a longer period of months. Not to exceed 4 weeks of real efficient work is experienced, the remainder of the approximate 8 weeks' time in which to do the job is partially and largely occupied by the building up and tearing down of the organization and outfit. For instance, it is believed that if funds had been available for a full force run of 10 days more at the time we commenced tearing the organization down (June 13), the cost over the whole project would have been reduced automatically by 15 or possibly 20 per cent. At this time 2,000 trees were being treated per day at a cost of $1,700 per day, or 85 cents per tree. Camps were generally well supplied with subsistence supplies and forage, and a fair amount of supplies at the warehouse, so that the expense could have been maintained at $1,700 per day for a 10-day period without difficulty.

A number of tabulations pertaining to production and costs follows. In recording this an effort is made to give such detail as will enable one to analyze the cost if desired. In these tabulations are found the 1928 figures, and for the sake of comparison the figures for 1927 are carried out to the right of the 1928 column.

Production Records and Costs

SPOTTING

	1928 Acres	1928 Trees	1927 Acres	1927 Trees
Spotted on Deerlodge	9,280	8,641	1,560	1,643
" " Beaverhead	54,619	50,071	18,520	17,248
Total spotted	63,899	58,712	20,080	18,891

	(1928)	(1927)
Total effective man-days spotting	2,021	729.7
Total all man-days "	2,564	999.2
No. trees spotted per effective man-days	30.25	25.9
" " " " total man-days	22.9	18.9
Cost per tree based on effective man-days	$0.165	$0.208
" " " " " total man-days	$0.218	$0.287

TREATING

	1928 Acres	1928 Trees	1927 Acres	1927 Trees
Treated on Deerlodge	8,631	7,987	1,520	1,681
" " Beaverhead	51,649	47,058	17,068	15,865
Total treated	60,280	55,045	18,588	17,546

	1928	1927
Total effective man-days treating	7,408	2,852¾
Total all man-days treating	9,550¾	3,277½
No. trees treated per effective man-days	7.43	6.15
" " " " total man-days	5.76	5.35
Cost per tree based on effective man-days	$0.630	$0.662
" " " " " total man-days	$0.775	$0.739

	1928	1927
Actual labor expense both treating and spotting based on effective days' work -	$0.795	$0.87
Actual labor expense both treating and spotting based on total man-days chargeable -	0.993	1.026
Total noneffective time cost on crews - -	0.198	0.156

(The figures being given on a per tree basis).

This noneffective time was spent in moving camps, setting up camps, cutting wood, kitchen work, hauling hay, building corrals, repairing fences, building and repairing bridges, roads and trails, filing saws, etc., all of which are indirectly chargeable to treating since the work becomes necessary in connection with the treating work. The increase in noneffective time in 1928 over 1927 is due to a greater percentage of camp moving, and much more road and trail work.

The above figures are only for the men engaged at the camps. Contributed time is included as well as that paid from I.C. funds. Loss on board is also included. Men were charged $1.00 for board, whereas the cost is $1.46 per day as against $1.53 in 1927. No time of unit managers, central overhead, or men engaged in transportation work is included in the above.

The amount vouchered against I.C. funds on the 1928 job was $95,472.80, with contributed time being $2,864.64, making a total of $98,337.44. Total number of trees treated was 55,045, at a gross cost of $1.786 per tree. This gross cost covers the 99.3 cents above shown and also includes all overhead, transportation, purchases of equipment, forage, hire of skid horses, and miscellaneous costs. The direct crew cost of $0.993 per tree for 1928 compares with $1.026 for 1927, also the gross cost of $1.786 per tree for 1928 is to be compared with $1.998 for 1927 work.

In order to show the gross expenditures and the gross cost per tree for 1928, and the gross cost per tree for 1927 as a comparison, the following tabulation is given.

Total allotment F.Y. 1928	$ 95,000.00
Transferred to District 4	150.00
Balance remaining, District 1 for 1928	$ 94,850.00
Total District 1 allotment for 1929	$ 2,500.00

Vouchered against the 1928 fund	$ 94,670.75
" " " 1929 "	802.05
Total vouchered this job	$95,472.80
Contributed time	2,864.64
Total expenditures	$98,337.44

Based on 55,045 trees treated:

Item	1928 Total Cost	Total cost per tree for spotting & treating 1928	1927
1. Net payroll for men and horses other than transportation	$44,767.38	$.813	$.905
2. Subsistence supplies	17,994.43	.327	.492
3. Commissary other than meals	2,065.85	.037	.034
4. Horse feed, shoeing, etc.	1,598.15	.029	.041
5. Transportation costs	7,193.54	.130	.149
6. Equipment and supplies	14,041.78	.255	.184
7. Travel	4,802.85	.088	.106
8. Misc. telephone, rent, etc.	588.63	.011	.016
9. Overhead	5,284.83	.096	.071
Total	$ 98,337.44	$1.786	$1.998

It will be seen the above tabulation includes the contributed time; in fact, this total covers the gross expenditure for everything. It is seen that the cost per tree for all purposes except equipment and overhead expense is reduced below the 1927 cost. The overhead cost is not believed to be unreasonably high as compared to 1927, where it certainly was too light. The equipment increase is due to the necessity for buying the bulk of the stuff needed for the job. There was expended for equipment and supplies an item of $14,041.78. Of this amount, it is figured $12,117.15 covers cost of equipment of a substantial kind, which is good for at least five seasons of such work, since all of it was new material. Of this amount, in figuring

the true or net cost, only 20 per cent depreciation should be considered as an actual cost rather than the full purchase price. Similarly, there was in use equipment to the value of $3,226.38 purchased in 1927, on which 20 per cent depreciation was figured last season, and should again be allowed this season. On this basis costs would be shown as follows:

Total expenditure from allotments and contributed	$98,337.44
Less equipment cost	12,117.15
	$86,220.29
Equipment purchased 1927 - $3,226.38 at 20% = 645.28	
" " 1928 - 12,117.15 at 20% = 2423.43	3,068.71
Total net cost	$89,289.00

Based on 55,045 trees, the net cost is $1.622 per tree.

This is made up as follows, showing a similar determination of net cost for 1927 so they may readily be compared with 1928 costs.

Basis 55,045 trees treated: Item	1928 Total Cost	Total cost per tree for spotting & treating 1928	1927
1. Net payroll for men & horses other than transportation	$44,767.38	$ 0.813	$ 0.904
2. Subsistence supplies	17,994.43	.327	.431
3. Commissary other than meals	2,065.85	.035	.034
4. Horse feed, shoeing, etc.	1,598.15	.029	.041
5. Transportation costs	7,193.54	.130	.148
6. Equipment & supplies $1,924.63 totally used up and 20% depreciation on $15,343.53	4,993.34	.096	.037
7. Travel, forest officers	2,237.59	.040	.07
8. Travel, temporary men	2,565.26	.046	.027
9. Misc. rent, lights, telephone, etc.	588.63	.010	.015
10. Overhead	5,284.83	.096	.071
Net cost per tree total	$ 89,289.00	$ 1.622	$ 1.778

These figures given in the table on page 27 show a gross cost of $1.786 per tree for 1928, and $1.998 for 1927, or a reduction in gross cost of $0.212, or 10.6 per cent. The table on page 28 shows a net cost of $1.622 per tree for 1928, as against $1.778 for 1927, a reduction of $0.156 per tree, or 8.8 per cent.

The cost of boarding men this year is slightly lower than last.

The average costs for the entire project are given, based on 47,660 meals (43,304 in camps and 4,356 purchased at restaurants and ranch houses).

Item	Per meal 1928	1927
Subsistence supply cost	$ 0.367	$ 0.313
Wages, cooks, and flunkeys	.091	.105
Transportation	.03	.092
	$ 0.488	$ 0.51

Transportation costs are very reasonable, about 1½ cents per pound. Wages are not unreasonable. Subsistence supplies appear high as compared with last season. Reasons for this are all the 4,356 meals bought on the outside were carried in our accounts as a subsistence supply cost, no portion of the cost of these being charged to wages or transportation. Had this been done it would raise wages and transportation and lower subsistence supplies slightly. Other reasons are the much higher cost of both smoked and fresh meats, eggs, and butter. Board was furnished which would compare favorably with the better camp fare found throughout the region.

The cost per day is $1.464, and a charge of $1.00 per day was made for board. This loss of $0.464 per man-day was included in all foregoing cost figures.

Forest Personnel and Cooperation

There were 36 forest officers from various parts of District 1, 5 from District 4, 1 each from Districts 2 and 6, making a total of 43. These men were not all engaged throughout the job, but the average for the period May 10 to June 15 was about 40 forest officers. Those from other Districts were all excellent men and rendered us very material assistance in the work. The same is true of the District 1 men. All of them worked faithfully endeavoring to make the job as successful as possible.

The Supervisors' headquarters of the Beaverhead, Deerlodge and Bitterroot Forests cooperated and assisted us in getting labor and supplies requested of them. The District office rendered assistance in everything which was needed from Missoula. Central Purchase did most of the buying and putting out of bids, except for the local purchases. The help and service rendered by Maintenance and the Missoula warehouse were very satisfactory. Orders were promptly filled and goods supplied were satisfactory. Few errors occurred and such as did were of little consequence and easily adjusted.

Forest Insect Reconnaissance

To secure an estimate of the number of trees which were attacked during the past season, as well as the extent of the infestation, an extensive reconnaissance of the Beaverhead National Forest was made during the months of August, September, and October, 1928. The following tabulation summarizes the cost and production data of this survey.

Items	Total	Per Man-day: Effective Man-day	Per Man-day: Total Man-Days
Man-days spent on survey	357	290	357
Miles of sample strip	1,779.97		
Miles of sample strip per man-day		6.13	4.98
No. of sample strip acres	14,240.60		
No. of sample strip acres per man-day		49.10	39.89
Acres covered by survey	622,080		
Acres covered per man-day		2,145.10	42.52
Total cost of survey:			
Labor $1,152.04			
Transportation 257.81			
Equipment 21.19			
Travel 70.64			
Subsistence 597.35	$ 2,099.03		
Cost of survey distributed		1,705.09	393.93
Cost per man-day		7.24	5.88
Cost per mile of strip	1.18		
Cost per sample acre	.15		
Cost per acre of region surveyed	.003		
Per cent of total area actually covered	2.2		

The method followed in making this survey was to run, on general compass lines, mechanically-selected strips throughout the area. Along the one-chain wide strips, the lineal distancesof which were paced, both the 1927 and 1928 attacked trees were counted and their location recorded. The data secured were then reduced to an acreage basis and the result applied to the unit under consideration. Though perhaps subject to some variations, a very fair estimate of the status of the epidemic is secured in this manner.

A brief tabulation of the present conditions within each of the different units follows.

Unit	Acres	New Attacked Trees per Acre	1928 Trees	1927 Trees	Increase
Pintlar	21,760	.839	18,278	5,440	236%
Mussigbrod	20,480	2.139	43,827	7,168	511%
Battlefield	37,120	.769	28,582	3,712	669%
West Side	33,280	.669	22,297	1,996	1017%
Jackson	28,160	.859	24,217	3,097	682%
Bloody Dick	61,440	.479	29,491	6,144	380%
Horse Prairie	24,320	.479	11,673	5,836	100%
Rattlesnake	48,000	.054	2,592	--	2592%
Grasshopper	41,600	.013	540	540	--
Warm Springs	51,200	.370	18,944	1,024	1750%
East Side	49,280	.659	32,524	8,870	266%
Upper Wise River	144,000	.066	9,504	2,160	340%
Lower Wise River	61,440	.103	6,328	614	931%
Totals	622,080		248,797	46,601	

From the units shown in the above summary it will be noted that the infestation now covers practically the entire Beaverhead National Forest. Furthermore, it will be seen that there are now 248,797 infested trees which would require treatment if the present project is continued in 1929. For a more detailed description of the present status of conditions within the Beaverhead Forest, reference is made to the final report of the 1928 survey of the Big Hole Basin.

It may be assumed by the readers of this report that the data secured by this survey proved to be surprisingly discouraging. Though discouraging, the results secured were not a surprise. It was hoped that a marked reduction would follow the 1928 control work, but a heavy flight of beetles from the Bitterroot was expected and feared. The situation as it now exists and its occurrence, with the exception of the infestation to the south, has been foreseen and predicted in all previous reports. The data secured from the southern units were surprisingly discouraging, and can only be accounted for through a flight of beetles from the Salmon infestation.

For the past few years there has been no apparent abatement in the Bitterroot infestation, and the situation on the Salmon has increased into a tremendous epidemic. Furthermore, there can be no doubt but that the insects are spreading from these two regions into the Beaverhead National Forest. Within these two regions there is sufficient timber remaining to maintain a serious epidemic for at

least five or six more years. If we assume that the physical difficulty of conducting such a large project could be overcome, the fact that control measures will be necessary for at least five more years, with the assurance that for the next two or three years the flight of beetles from the Bitterroot and Salmon will be even heavier than in the past, make the thoughts of continuing the present project economically unsound. This would seem to be even more apparent for, even though the project be adequately continued for an indefinite period, no assurance can be given that the spread of the insects into the more valuable timber stands to the south will be checked, which is the primary objective of the project.

In view of these self-evident facts which make the thoughts of further control work within the Big Hole Basin prohibitive, it has been recommended that the project be discontinued.

Respectfully submitted,

C. A. Webb.
Logging Engineer.

James J. Evenden
Entomologist.

December 12, 1928